play irregularly, and the Law of Fatigue will not apply to them; and the statement of that law leading to the cubical hyperbola must be modified as follows:—

Let there be m fibres tired out,

And n fibres worked but not tired out;

And let x be the mean weight held in the hand lifted by the fibres n; then the weight really lifted by the fibres m will be $(w + a - x)$. And it is to this quantity only that the Law of Fatigue applies, giving us the formula

$$n(w + a - x)^2 = A. \quad (4)$$

In Mr. Nipher's first set of experiments at fixed rate we found—

$$a - x = + 1{\cdot}094.$$

And in his experiments now published we have—

$$a - x = - 1{\cdot}276.$$

From this (supposing the experiments not damaged in their reduction) I should infer that the supraspinatus and acromial deltoid were aided, irregularly, in the two cases by muscular fibres (not tired out), which lifted respectively 0·41 and 2·77 kilos.

Trinity College, Dublin, March 13 SAMUEL HAUGHTON

P.S.—I have received a letter from Prof. Gustavus Hinrichs, of Iowa State University, in whose laboratory Mr. Nipher was assistant, and who gave Mr. Nipher all possible aid in his experiments. In this letter Prof. Hinrichs states that Mr. Nipher's former experiments were in fact as good as those he last made. I myself believe that, in some respects, they were better.

Denudation

MANY students of geology find a difficulty in realising that the effects of denudation are due to the simple action of water set in motion only in ways familiar to us. To them, and indeed to many others, it may be of some interest to observe a working model which, though made without any such design, shows with curious fidelity, on a small scale, the effects which have been produced in the lapse of ages on the great features of our globe.

Londoners will remember that the Serpentine was emptied, cleaned out, and finally refilled about five years ago. Coping-stones of hewn granite were laid along the margin of the foot-path, and from this, slanting down for about two feet, was a layer of concrete laid about the level of the water line. Possibly this concrete was not of the most durable quality, still it was certainly harder than most of the rocks which bound our coasts. But in the short space of about five years the tiny wavelets of this little lake have worked this *smooth sloping hill* into a bold and rugged line. In some places, indeed, all the concrete has been washed away, and there is a sandy beach right up to the granite. Two or three years ago the water was at a somewhat lower level than it is now. The traces of the change are recorded, especially on the north side, a little to the east of the boat-houses. There, a double range of "cliffs," one over the other, is to be seen extending for some considerable distance.

This "*model*" is indeed of so much interest that I ask you to insert this notice of it, for I am sure that many of the readers of NATURE would share the pleasure I have felt in watching the very striking similarity in effects produced by the same agents working on scales so vastly different. R. H.

OUR ASTRONOMICAL COLUMN

THE SUN'S PARALLAX.—In *Astron. Nach.*, No. 2,033, Prof. Galle, Director of the Observatory of Breslau, gives his final deductions with reference to the value of solar parallax from corresponding observations of the minor planet Flora, about the opposition of 1873, which took place while the planet was near perihelion. Observations with this special object in view were made at the Observatories of Bothkamp (Herr von Bulow), Cape of Good Hope, Clinton (N.Y.), Cordoba, Dublin, Leipsic, Lund, Melbourne, Moscow, Parsonstown (the Earl of Rosse), Washington, and Upsala; by 37 N. and 36 S. stars, the sun's parallax is inferred to be 8″·879 (± 0″·0396), which, singularly enough, is the exact figure lately communicated by M. d'Abbadie to the Astronomer Royal, as a first result obtained by M. Puiseux, from observations of the recent Transit of Venus at the French stations at Pekin and St. Paul Island.

TUTTLE'S VARIABLE NEBULA IN DRACO, &c.—This object well deserves regular observation, the evidence in favour of its variability being apparently beyond question. It was first seen by Tuttle in September 1859, and occurs in Argelander's Durchmusterung. On the 24th of September, 1862, D'Arrest, observing with the Copenhagen refractor, describes it as a large bright nebula, 2′ long and 80″ broad, and he adds: "bene conspicienda tubo quæstore." On the 22nd of August, 1863, after re-examination, he has the note: "I think this nebula was far brighter in the year 1862," and on the 12th of the following month he remarks: "tubo quæstore non amplius discernitur." In a letter to Sir John Herschel, he expresses his conviction that the nebula could not have been so bright as it was in September 1862, in the time of Sir W. Herschel and Messier. Auwers, in Königsberg Observations, xxxiv. p. 227, says he found the nebula pretty bright, 2½′ long, 1½′ broad, the direction of the longer diameter being 50°. If we take the mean of D'Arrest's observations for position (*Siderum Nebulosorum*, &c., p. 333), and bring up to the commencement of 1875, the following place results:—

R.A. ... 18h. 23m. 16s. N.P.D. ... 15° 29′·5

This nebula is No. 4,415 of Sir John Herschel's general Catalogue. We are able to state that there is some suspicion of variability about No. 4,369 of the same Catalogue (Hind, 1852, April 26), and possibly in the small hazy-looking star preceding the brightest part of the nebula. In April 1852 it was very small and rather faint, perhaps 1′ in diameter; it followed Lalande, 33076, 50·1s., and was 9′·4 north of the star. Auwers (Königsberg Observations, xxxiv. p. 227) found it pretty faint, 2′ diameter, gradually a little brighter towards the middle; a star 12th magnitude situate on the border of the nebula on an angle of about 230° from its centre. Later observations have afforded indication of fluctuating brightness, but are not decisive. Auwers thought he found signs of variability in the nebula No. 4,473 (Hind, 1845, March 30). In a 6-feet Fraunhofer it was pretty bright, round, and from two to three minutes in diameter; and once, 1860, Aug. 16, with the Königsberg heliometer it was "surprisingly faint and of the second class at the highest." Schönfeld has several observations in *Astronomische Beob. zu Manheim*, 1862; the diameter is variously recorded between 45″ and 2′, and once it is remarked that the nebula showed strong scintillation and appeared resolvable. D'Arrest, who independently discovered this nebula in the spring of 1852 (*Astron. Nach.*, No. 809) has given his earlier observations in *Resultate aus Beob. der Nebelflecken, Erste Reihe;* in September 1855 he suspected it might prove a cluster of very minute stars. His later observations with the Copenhagen refractor are published in *Siderum Nebulosorum*, &c., where he states that he had not, during sixteen years, noticed any change either of brightness or position; and he mentions further that in April 1866 he detected a number of luminous points. Variability in the case of this object appears hardly to rest upon sufficient proof, considering the effect of indifferent nights upon such observations, but it is suggested in Sir John Herschel's last Catalogue, and on that account is referred to here.

COMET 1766 (II.)—If Burckhardt's elliptical elements of the second comet of 1766, discovered at Paris on April 8, are approximately correct, it is not improbable that the comet was observed on its first perihelion passage with that form of orbit. Burckhardt succeeded in representing the rough observations of La Nux at the Isle of Bourbon, extending to May 13, by an ellipse with a period of only five years, Pingré having failed in bringing them into satisfactory agreement with the few observations taken by Messier and Cassini de Thury, at Paris.

from the 8th to the 12th of April, in a parabolic orbit. With the period assigned by Burckhardt, the comet would have passed its aphelion in October or November 1763, at which time the planet Jupiter was near the same heliocentric longitude, and his distance from the comet might have been less than 0·4; indeed, a period very slightly shorter than Burckhardt's, and quite within the probable error of his determination, might have occasioned an extremely close approach of the two bodies, producing, in all probability, a great alteration of elements, and resulting in the ellipse of short period indicated by the observations of 1766. This comet was suspected by Clausen to have been identical with the comet of July 1819, or the comet of Winnecke, which has been observed during the present year; and the very possible close approach to the planet Jupiter in the autumn of 1763 may have been the cause of the introduction of this body amongst the quickly revolving comets of the system. It is also to be remarked that Burckhardt's orbit for 1766 points to a close approximation to the orbit of Mercury; in about heliocentric longitude 290°, the distance is less than 0·025.

THE SOLAR ECLIPSE

IN continuation of our articles on this subject, we print the following telegrams which have since been received, detailing the results of the observations; together with some remarks which have appeared in the *Times* concerning them.

First, with regard to the Siam party we have, from Singapore, April 15, the following Reuter's telegram with respect to the results obtained:—

"Valuable results were obtained by the English observers of the solar eclipse in Siam. Although the sky was hazy, the results by the prismatic camera were good. The spectroscopic cameras failed. Eight good photographs of the corona were taken."

Next, a *Times* telegram from Dr. Schuster, at Bangkok, as follows:—

"The English observers of the solar eclipse in Siam are remaining a few days at their station to take copies of photographs obtained. Unavoidable accidents prevented them being on the spot until five days before the eclipse. Owing to the untiring energy of Capt. Loftus, the arrangements were nearly complete, and thus partial success of the expedition secured."

Next, a *Daily News* telegram from the special correspondent of that journal with the expedition at Bangkok:—

"The results of the English Eclipse Expedition must be considered merely preliminary, this being the first time spectrum photography has been tried. The prismatic camera shows the rings with protuberances at the edge of the sun, and at least one more ring towards the ultra-violet without protuberances. Eight good photographs of the corona were taken, the exposure varying from two to sixteen seconds."

It will be observed that in none of these telegrams was Dr. Janssen mentioned. It is possible, therefore, that he left Singapore before the arrival of the English Expedition. Be this as it may, he observed the eclipse in Siam, and on Monday last, at the Paris Academy of Sciences, a telegram was read from him to the effect that though the sky was not clear, he obtained results, and that these were confirmatory of those obtained in 1871, so far as they related to the coronal atmosphere.

The news received from the Camorta party is a sad contrast to the above. The following Reuter's telegram, dated "Calcutta, April 18," will no doubt cause universal regret:—

"The Indian astronomical party at Camorta were successful in observing the external contacts during the solar eclipse. They failed, however, to obtain photographic results, owing to the sky being completely overcast during totality."

The *Times*' comments on the results obtained at Siam are as follows:—

"Reading the above telegram from Dr. Schuster in connection with that which we published in our second edition on Wednesday last (NATURE, April 15, p. 474), we see that two-thirds of the work which the Siam expedition went out to do have been successfully accomplished. Photographs giving us the actual shape and many of the conditions of the coronal atmosphere at the present epoch of minimum sun-spots have been secured, and these photographs we shall be able to compare with those taken in India and Java in 1871 at the time of maximum sun-spots. It is not too much to hope that this comparison may teach us much as to the changes in the solar atmosphere which accompany or are brought about by the changes in the spots—changes which require eleven years or thereabout to run through their cycle. But this, after all, is a trifle compared with another part of the work. Not only was photography *pure et simple* employed to tell us the shape and other conditions of the solar atmosphere, but photography *plus* spectroscopy has been utilised to tell us the chemical constitution of the various readings of the sun's surroundings; and it is in this branch of the work that the most valuable of the announced results have been obtained. The Committee of the Royal Society laid so much stress upon this part of the attack that no less than three instruments were devoted to it by the Siam party alone, the work of each being so arranged that it would supplement that accomplished by any of the others.

"A few simple considerations will serve to indicate not only the nature of this part of the work, but how carefully it had been prepared throughout by those upon whom the responsibility of organising the expeditions fell. The brilliancy of the corona has varied enormously—one, indeed, might almost say impossibly—in various eclipses. The celebrated Otto Struve, for instance, has placed on record the fact that in one of the eclipses which he observed its brilliancy was almost insupportable to the naked eye; other astronomers have made use of expressions equally strong, while it is known that, if those who are fortunate enough to have the opportunity of observing eclipses take the precaution of guarding the eye from the direct light of the sun before its disappearance, there is not only light enough from the corona to read by with comfort, but a light surpassing in brilliancy the brightest moonlight we are familiar with in these latitudes. This is so far as the eye is concerned. When we deal with the photographic plate instead of the retina, the brilliancy of the corona becomes yet more certain. A camera of, say, four inches aperture will impress an image of the corona on a prepared plate in far less time than it will impress an image of the moon at its brightest. This is one indication of the photographic brilliancy of the coronal light, and in a former article we took occasion to refer to others of an equally striking kind which were rendered very obvious during the eclipse of 1871. The evidence as to the brightness of the spectrum of the lower layers of the sun's atmosphere is equally strong."

"The Royal Society Committee, therefore, would have been justified in reckoning upon a bright corona. They did so, but at the same time they provided for a very feeble one. Long before the expedition sailed, the members of both parties made some very interesting researches on the possibility of securing photographs of gaseous spectra—that is, precisely such spectra as those which it is natural to expect will be furnished to us by the corona. They found that, with a time of exposure only slightly in excess of that allowed by the eclipse itself, they were enabled to photograph the spectra of chlorine, nitrogen, and other similar bodies under somewhat complicated instrumental conditions, and when those spectra